



**BAUERBERG KLEIN**  
TRAINING & CONSULTING





## Module 1

# FUNDAMENTALS OF WELL PERFORATING

# CONTENT

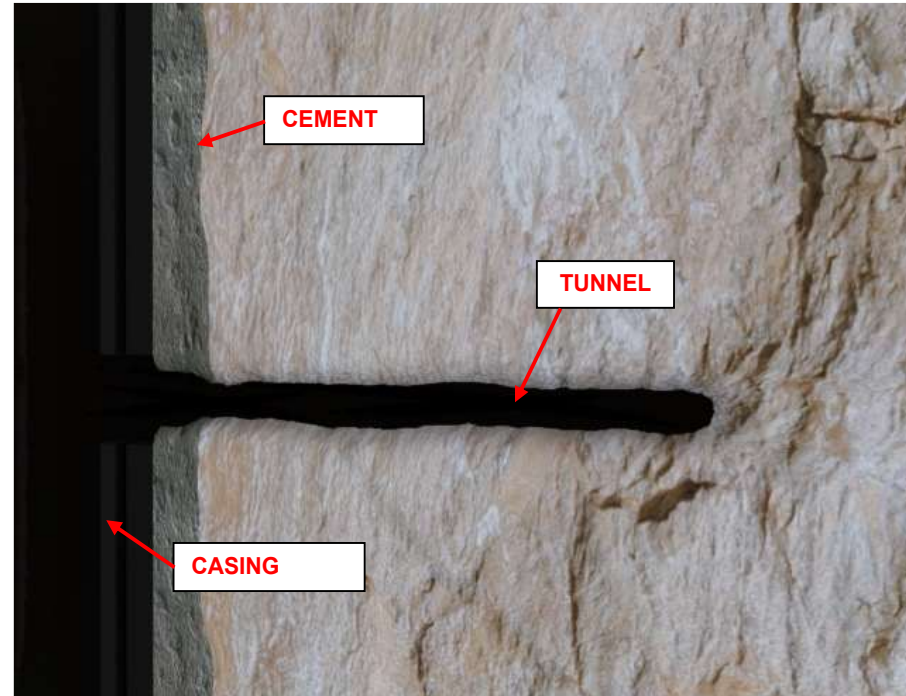
- *What is well perforating*
- *Objectives*
- *Brief history of perforating*
- *Typical types of perforating systems*
- *Advantages and disadvantages of each system*

## WHAT IS WELL PERFORATING

It is a process by which a charge fired from a perforating gun, goes through the casing & cement and penetrates the reservoir rock

The penetrating effect of the charge should create an effective and efficient communication path for hydrocarbons to flow into the wellbore

Effective because the path is created and efficient because it will allow passage of fluids from the reservoir with the minimum use of energy (Pressure)



## OBJECTIVES OF PERFORATING

Depending on the type of reservoir rock other objectives can be:

- The flow path can be a deep penetrating tunnel into the reservoir
- Or it can be a stable cavity instead of the tunnel
- Provide better mechanical conditions to mitigate/minimise sanding
- Flow path created must allow fluid flow with the minimum pressure drop possible
- It must be a fit for purpose process

## BRIEF HISTORY OF WELL PERFORATING

- History dates from 1888 when C.E. Monroe published some observations about perforating
- First patent granted in 1926, technology was based on the use of a lead bullet fired from a gun
- Military technology was introduced in the 1930s based on charges use to perforate armour in tanks. Munitions for the “bazooka” is a typical example
- The use of explosives and shaped liners were introduced in 1966



## TYPES OF PERFORATING SYSTEMS

Perforating systems can be classified according to various parameters such as type of rock or deployment method. According to deployment method we have four (4) different systems

1. Wireline conveyed – Electric cable or solid wire
2. Tubing conveyed – Completion tubing or drill pipe
3. Through tubing systems – With wireline and through the completion string
4. Coiled tubing deployed – Similar to wireline conveyed but with the circulation capacity of CT

## WIRELINER PERFORATING SYSTEMS

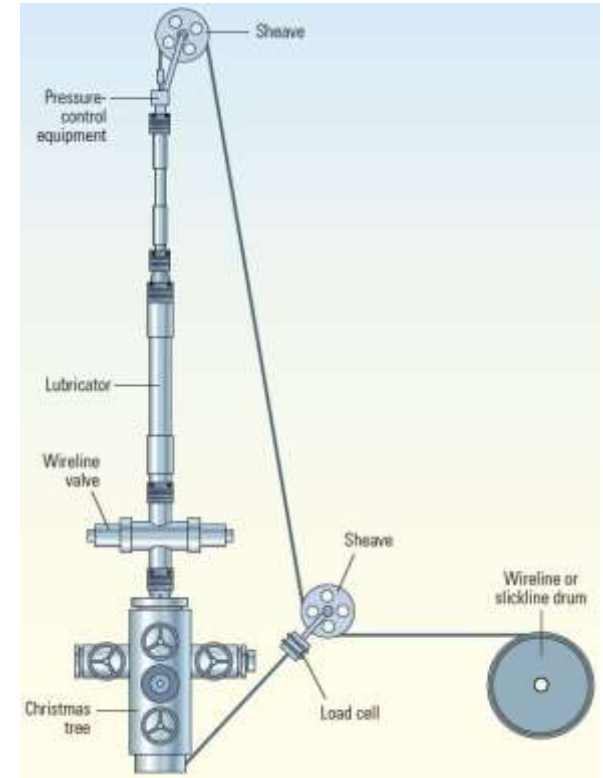
Consists of using electric wireline or solid line to convey the gun and activate the charges.

### Advantages

- Accurate depth control
- Quick deployment and retrieval
- Pressure control
- Rig less

### Disadvantages

- Limited length of gun due to its weight
- No circulation capability



Wireline Surface set up - Courtesy of Schlumberger



## TUBING CONVEYED PERFORATING - TCP

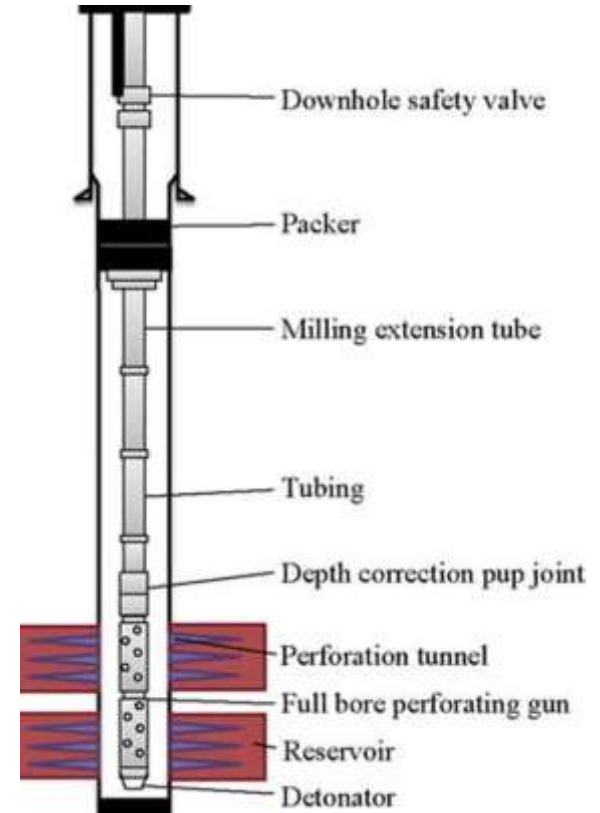
Guns are attached to the tail pipe of the completion

### Advantages

- Time saving
- Maximum gun's length deployment
- Larger diameter gun possible

### Disadvantages

- Rig required
- Limited depth control
- No pressure control



## THRU-TUBING PERFORATING SYSTEMS

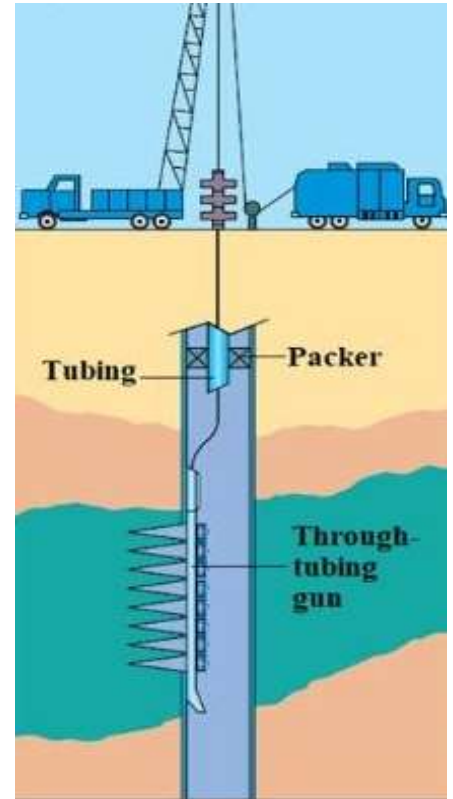
Guns are deployed through the existing completion string

### Advantages

- Rig less
- Quick deployment and retrieval
- Pressure & depth control

### Disadvantages

- Gun diameter is limited by the tubing size & restrictions
- Well deviation “limits” maximum depth
- Gun length limited by cable/wire resistance



## COILED TUBING PERFORATING SYSTEMS

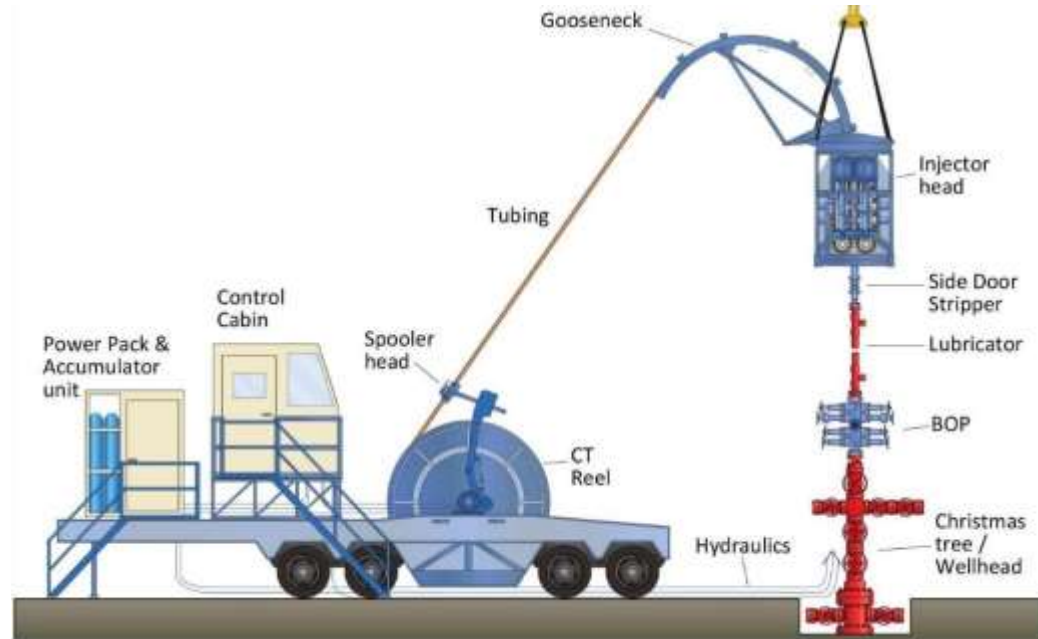
Guns deployed using coiled tubing, activation can be mechanical or via an electric cable.

### Advantages

- Rig less deployment
- Possible to deploy in long horizontal wells
- Pressure control
- Fluid circulation is possible

### Disadvantages

- Depth control is limited
- Costly operation



## MODULE 1 - SUMMARY

Perforating is the process to establish a effective and efficient connection between the well and the reservoir. This connection takes the shape of a tunnel or a cavity depending on the type of reservoir rock being perforated

Well perforating dates from 1888, the first patent was issued in 1926 for a gun that fired a bullet to penetrate the casing, cement and reservoir rock. Explosives and shaped charges were introduced in 1966

There are four (4) types of commonly used perforating system: wireline deployed, tubing deployed, through tubing guns and coiled tubing deployed systems

Advantages and disadvantages exist for each system but in general they cover the most common requirements for most types of reservoirs and well conditions



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